Comments on Perception of tone with particular reference to temporal alignment by David House

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In speech analysis, acoustics and phonology can be considered as two distinct fields, with phonetics in between them. Schematically speaking, the acoustic processing of the speech signal consists in extracting phonetically meaningful cues, and the phonetic processing of speech consists in extracting phonologically meaningful features of speech. In other words, phonetics constitutes the interface between acoustics and phonology. Dr. David House’s model of tonal perception finds its place within this phonetic interface. The model works efficiently in two ways, that is, from acoustics toward phonology, for the description of tonal phenomena, and from phonology to acoustics, as part of a speech generation system (TTS).

The key notions that characterize his studies are: temporal constraints, tonal alignment, spectral stability/instability, and syllabic environment. These four parameters have proved useful in determining the output of the model, which comprises high/low level tones and rising/falling contours.

In order to develop this model, the author has been carrying out, over the last ten years, numerous experiments on tonal perception using well-controlled synthesized stimuli. Results were each time examined in reference to thresholds in pitch discrimination, pitch change discrimination, etc., which gives the model a physiological basis accounting for the universal aspects of perception.

Dr. David House experiments have proved efficient for Swedish, a language containing two pitch accents, and which implies that the subjects have developed a sensitivity in discriminating the tonal movements in the speech sequences of that language. In that sense, his model may constitute an ideal case of tonal perception.

As an illustration, I will present results from perceptual experiments we have been carrying out on the Tokyo Japanese pitch accent (Ayusawa 1998, Ayusawa & Nishinuma 1997). We have used 144 natural stimuli containing 3, 4, and 5 syllable words with all possible combinations of accent patterns. These have been presented to learners of Japanese from 29 languages. Note that the Japanese pitch accent is produced with a falling contour from the last high mora, a necessarily accented syllable, to the following unaccented low tone mora. This accent pattern is most difficult to perceive for foreigners when produced in penultimate position in 5 syllable words. This is the case for English, Russian, Portuguese, Spanish, Italian, and French, which have low correct answer scores.

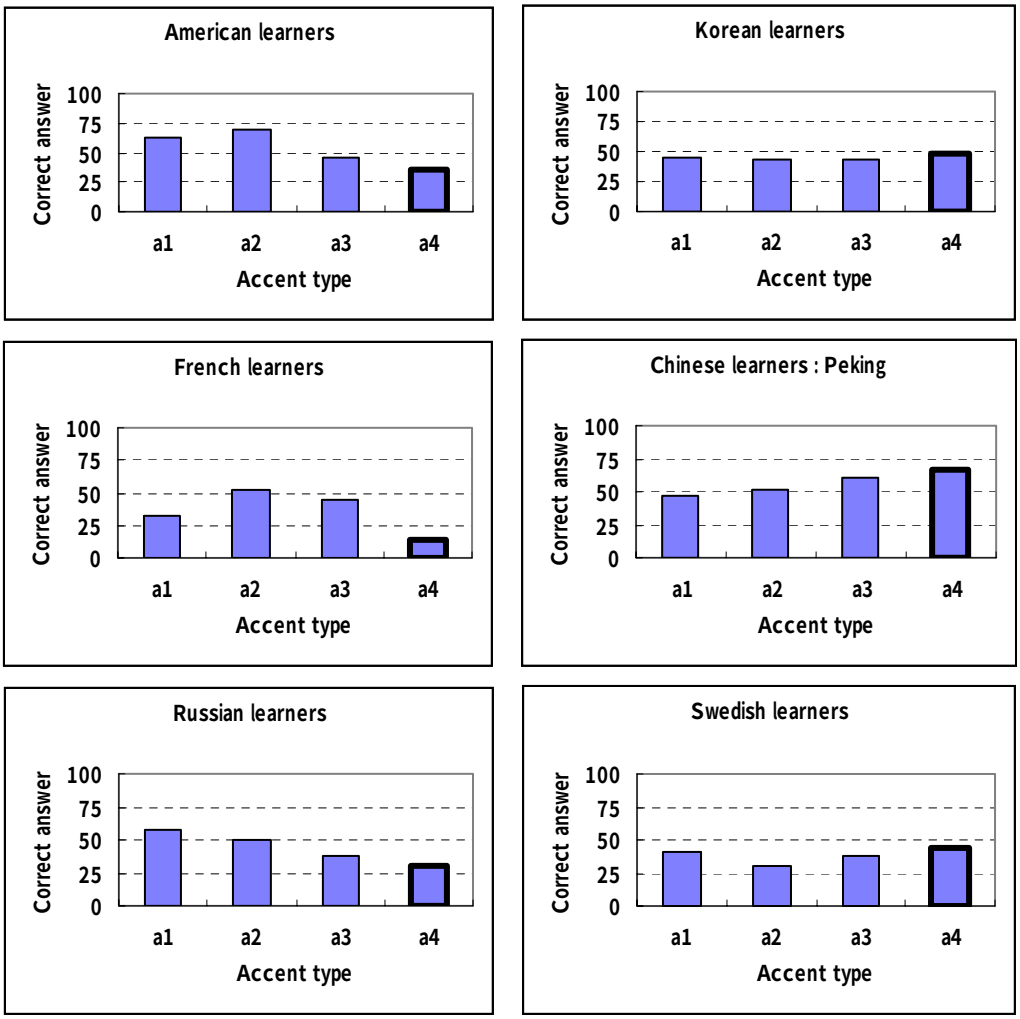

Figure 1 Perception of the Tokyo Japanese Accent.

Correct answer rates for each accent type of 5 mora words are presented to illustrate the two tendencies in the perception of pitch movements. The left column of the figure contains examples of the poorest results for the penultimate accent (a4), and the right column, the best results.

The left column on Figure 1 illustrates such typical cases. Whereas twice higher correct scores for the Chinese subjects (3 dialects, Beijing, Shanghai, and Hong Kong, are represented), the Korean, and the Germans, show this pattern is the easiest pattern for them to perceive. Comparable results were obtained for the advanced group of Swedish learners of Japanese (Nagano-Madsen & Ayusawa, 2002), as illustrated on the right column in Figure 1. This would imply that subjects adopt different perceptual strategies to physically identical stimuli, according to their language background.

The above-mentioned statements do not compromise David House's model in any way, since its output needs processing according to the constraints required by the target language before coming to the expected phonological categories.

References

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